THE ITALIAN UNIVERSITIES'
INTERNATIONAL MEDICAL ADMISSIONS TEST (IMAT)
TEST SPECIFICATION

In partnership with
Ministero dell'Istruzione, dell'Università e della Ricerca (MIUR)

February 201I

Test

Test Specification

Test Format

The IMAT will have the same structure as the existing Italian test. Candidates are allowed a total of F€0 minutes to complete the test.

Section 1

General Knowledge and Logical Reasoning (Critical Thinking and Problem Solving)

Gï multiple-choice questions.

Sections 2, 3 and 4

Science-based sections, covering: Biology; Chemistry; Physics &Á'T æ©@\{ æã&•

3Hmultiple-choice questions.

All questions have five options, of which one is correct.

Candidates record their answers on a separate answer sheet. Candidates can also indicate if they have opted not to answer a question.

Candidates are allowed F€0 minutes to complete the test.

Scoring

A candidate's total score is calculated using the following formula:

- 1.5 points for each correct answer;
- -0.4 points for each wrong answer;
- 0 points for each question not answered.

An overall total score will be reported, together with a score on each section.

Level of Difficulty

The level of difficulty of the test items will be targeted to discriminate effectively between applicants, including those who may have achieved the highest possible grades in school examinations.

Section 1: General Knowledge and Logical Reasoning (Critical Thinking and Problem Solving)

Section 1 will assess general knowledge and the logical reasoning skills that students must possess if they are to succeed in a course of study at the highest level. Such skills are basic to any academic studies, which often require students to solve novel problems, or consider arguments put forward to justify a conclusion, or to promote or defend a particular point of view.

General Knowledge

General Knowledge questions may address a range of cultural topics, including aspects of literary, historical, philosophical, social and political culture.

> **1** The World Heritage Convention, adopted by UNESCO in 1972, aims to identify and maintain a list of sites that may be considered:
>
> **A** of exceptional cultural or natural importance
>
> **B** of outstanding economic value
>
> **C** to be characterized by a lasting peace
>
> **D** to be conventionally suitable for human settlement
>
> **E** to have exploitable energy resources

Critical Thinking

Critical Thinking involves reasoning using everyday written language. Questions focus on the skills involved in understanding and evaluating arguments. These include: drawing and summarising conclusions, identifying assumptions and reasoning errors, and assessing the impact of additional evidence.

Summarising the Main Conclusion

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2   There has been a decline in the rate of many of the illnesses of old age. The causes of this decline include such medical advances as new drugs and surgical techniques. There is, however, another factor. The present generation of 60- and 70-year-olds had much better nutrition as children than did their parents. Good nutrition in childhood is important for good health in adulthood. Since improvements in nutrition have continued over the past sixty years, we can expect that many of the illnesses of old age will continue to decline.

Which one of the following best expresses the main conclusion of the above argument?

A We can expect that improvements in nutrition will continue.

B The rate of many of the illnesses of old age has declined.

C Medical advances have significantly reduced the rate of diseases of old age.

D The fall in the rate of many of the illnesses associated with old age will continue.

E Improvements in nutrition have been very important in maintaining good health in old age.

In this type of question you have to judge which one of the statements A to E best expresses the main conclusion of the argument. The conclusion can appear anywhere within an argument - not necessarily at the end. What you are looking for is the statement which follows from, or is supported by the rest of the passage.

Drawing a Conclusion

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3   The demand for blood donors is increasing all over the world. In Western countries, in particular, demand has been rising so rapidly that shortages have begun to appear. In all such countries, demand is growing much faster than rates of growth in populations aged 18-65, and it is this group who are the major blood donors. And, despite a massive research effort to find alternatives, it remains true that in medicine there is no substitute for human blood.

Which one of the following conclusions can be drawn from the passage?

A As the demand for blood has increased, so has the supply fallen.

B The rate of growth of the blood-donor population has been slowing recently.

C The increase in the rate of demand for blood is mainly due to population growth.

D If more blood donors could be found, there would be no need to find a substitute for human blood.

E The problem of the increase in demand for blood shows no sign of disappearing.

In this type of question you are asked which conclusion follows from the information given. You need to consider each of the statements A to E, and to think about

whether the information in the passage gives you good reasons to accept the statement.

Identifying an Assumption

> **4** Success in modern America is very much measured by the quantity of material possessions one has. A lack of material possessions means one is judged to be unsuccessful. Those people with few material possessions therefore must feel a strong sense of failure.
>
> Which one of the following is an underlying assumption of the above argument?
>
> **A** Most modern Americans are successful.
>
> **B** Success can be precisely measured.
>
> **C** Over-emphasis on material possessions creates social problems.
>
> **D** Excessive desire for material possessions is psychologically damaging.
>
> **E** People in America with few material possessions want to be seen as successful.

An assumption is something which is not stated in the argument, but which is taken for granted in order to draw the conclusion. So you need first to identify the conclusion of the argument. Then look for the reasoning it gives to support this conclusion, and think about any important point which is not actually stated in the reasoning.

Assessing the Impact of Additional Evidence

> **5** Zoos are entirely unsuitable places for animals. People visit zoos to learn about animal behaviour but the animals they see are likely to be behaving in abnormal and neurotic ways because of the cramped and unnatural conditions in which they are kept. Zoos should be closed and the money saved should be used for the protection of natural habitats.
>
> Which of the following, if true, would most weaken the above argument?
>
> **A** Humans living in cramped conditions can also become neurotic.
>
> **B** Schoolchildren can learn a great deal about animals from visiting zoos.
>
> **C** Many of the animals at present in zoos would not be capable of living in the wild.
>
> **D** The protection of natural habitats is very costly.
>
> **E** Zoos enable endangered species to survive by breeding them in captivity and then re-introducing them to the wild.

This type of question will typically ask you to consider what would weaken or strengthen an argument. You need first to be clear about what the argument is trying to establish. Work out what the conclusion is, and then consider what effect each of the possible answers would have on the conclusion.

Detecting Reasoning Errors

6 In order to succeed in academic examinations it is necessary to study. Therefore, if a student works hard in a particular subject, he or she should do well when it comes to the examination.

Which of the following best describes the flaw in the argument?

A It assumes that it is necessary to study in order to succeed.

B It overestimates the value of studying in preparation for examinations.

C It ignores the fact that some subjects are more academic than others.

D It assumes that studying hard is a sufficient condition for academic success.

E It ignores the fact that some students do not need to study very much in order to succeed.

This type of question asks you to identify the flaw in the argument, which means that you must explain why the conclusion does not follow from the reasons which are given. So you need to be clear about what the conclusion is, and what reasons are meant to support it.

Problem Solving

Problem Solving involves reasoning using numerical and spatial skills. Questions are of three kinds, each assessing a key aspect of insight into unfamiliar problems. The three kinds are Relevant Selection, Finding Procedures, and Identifying Similarity. Although most questions fall into one category some questions fit into more than one of the categories.

Relevant Selection

7 The following table gives figures for the percentage growth per year of labour productivity per person per year in various countries during three periods.

	Period 1	Period 2	Period 3
Japan	8.5	3.0	3.2
France	5.4	3.0	2.6
United Kingdom	3.6	1.5	2.4
Belgium	3.3	2.8	2.3
Sweden	4.1	1.5	1.8
Denmark	4.3	2.6	1.7
Italy	6.3	3.0	1.6
Netherlands	4.8	2.7	1.6
Germany	4.5	3.1	1.6
United States	2.2	0.0	0.8

Which country's percentage growth per year remained consistently greater than half of its Period 1 level in the following periods?

<u>A</u> Belgium

B Denmark

C France

D Germany

E United Kingdom

Very often a real world problem will be overloaded with information, much of which is unimportant. This kind of question demands Relevant Selection, in which the task is to select only that information which is necessary and helpful in finding a solution.

Finding Procedures

8 A child's bus fare is cheaper than the adult fare but is more than half the adult fare. The total cost of a single journey for an adult and two children is €1.20. Adult fares are all multiples of 10 cents.

What is the adult fare?

A 30 cents

B 40 cents

C 50 cents

D 60 cents

E 70 cents

Sometimes you will find that even if you have selected all the relevant information, no solution presents itself. For this type of question, you have to find a method or procedure which you can use to generate a solution.

Identifying Similarity

9 The graph below shows Mr Evans' bank balance at the end of each month in a year.
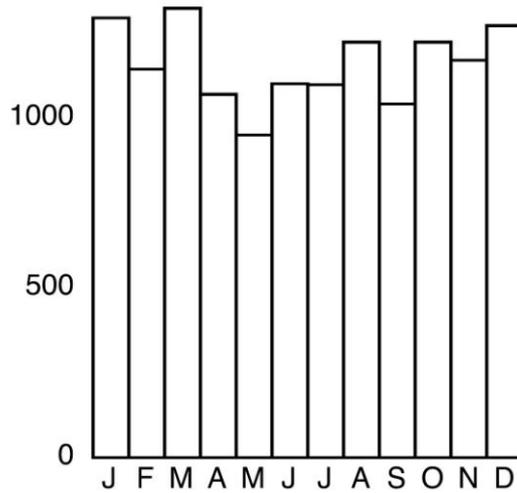
Which one of the following graphs could show the actual change in his bank balance each month?
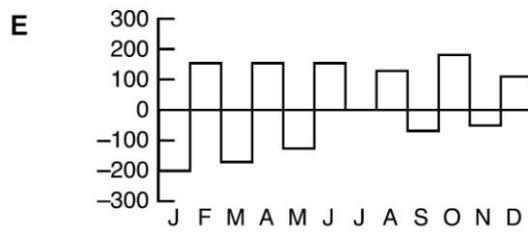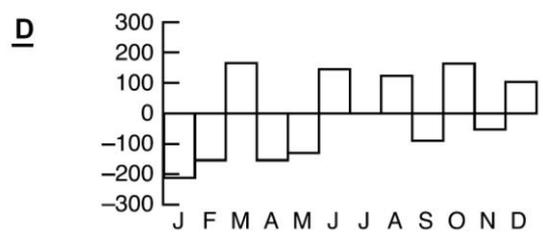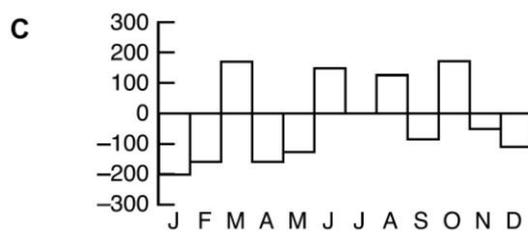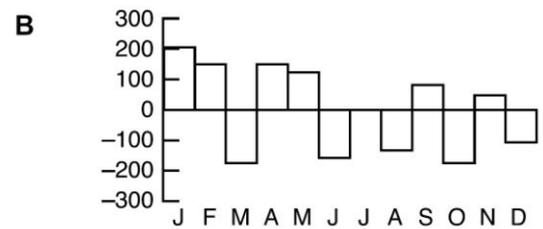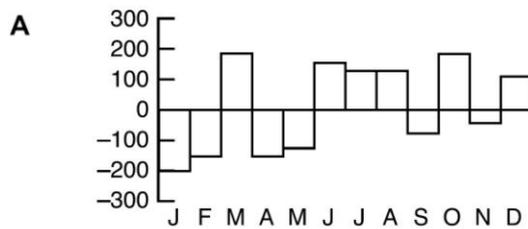
In this type of question you will be presented with information and asked to identify the same information presented in a different way, or a situation in which different information has a similar structure.

Section 2: Biology

The chemistry of living things

The bio-elements. The biological importance of weak interactions. Properties of water. Organic molecules in living organisms and their respective functions. The role of enzymes.

The cell as the basis of life

Cellular theory. Cell size. Prokaryotic and eukaryotic cells. The cell membrane and its functions. Cellular structures and their specific functions. Cell reproduction: mitosis and meiosis. Chromosomes. Animal tissues.

Bioenergetics

The energy currency of cells: ATP. Transporters of energy: NAD, FAD. Oxidation-reduction reactions in living things. Photosynthesis. Glycolysis. Aerobic respiration. Fermentation.

Reproduction and Inheritance

Life cycles. Sexual and asexual reproduction. Mendelian genetics. Basic laws and applications. Classical genetics: chromosome theory of inheritance; sex chromosomes, chromosome maps. Molecular genetics: DNA and genes, genetic code and its translation, protein synthesis. DNA of prokaryotes. The chromosome of eukaryotes. Regulation of gene expression. Human genetics: transmission of mono and multi-factorial features, hereditary diseases. New frontiers of genetics: recombinant DNA and its potential bio-technological applications.

Inheritance and environment

Mutations. Natural and artificial selection. Evolutionary theories. The genetic basis of evolution.

Anatomy and Physiology of animals and humans

Anatomy of the major organs and their functions and interactions. Homeostasis. Hormonal regulation. Nerve impulse. Transmission and processing of information. The immune response.

Section 3: Chemistry

The constitution of matter

States of matter; heterogeneous and homogeneous systems; compounds and elements.

The structure of the atom

Elementary particles, atomic number and mass number, isotopes, electronic structure of atoms of the elements.

The periodic table of elements

Groups and periods, transition elements, periodic properties of elements: atomic radius, ionization potential, electron affinity, metals and non-metals; relations between electronic structure, position in the periodic table and properties.

The chemical bond

Ionic bond, covalent bond, bond polarity, electronegativity.

Fundamentals of inorganic chemistry

Nomenclature and main properties of inorganic compounds: oxides, hydroxides, acids, salts; position in the periodic table.

Chemical reactions and stoichiometry

Atomic and molecular weight, Avogadro constant, concept of the mole, conversion from grams to moles and vice versa, elementary stoichiometric calculations, balancing simple reactions, various types of chemical reactions.

Solutions

Solvent properties of water, solubility, the main ways of expressing the concentration of solutions.

Oxidation and reduction

Oxidation number, the concepts of oxidising and reducing agents.

Acids and bases

Concepts of acids and bases, acidity, neutrality and basicity of aqueous solutions, pH.

Fundamentals of organic chemistry

Bonds between carbon atoms; molecular, structural and displayed formulae; concept of isomers; aliphatic, alicyclic and aromatic hydrocarbons; functional groups: alcohols, ethers, amines, aldehydes, ketones, carboxylic acids, esters, amides.

Section 4: Physics & Mathematics

Physics

Measures

Direct and indirect measures, fundamental and derived quantities, physical dimensions of quantities, knowledge of the metric system and the CGS System of Units, Technical (or practical) (ST) and the International System (SI) of Units (names and relationships between fundamental and derived units), and multiples and sub-multiples (names and values).

Kinematics

Kinematic quantities, various types of motion with particular regard to uniform and uniformly accelerating rectilinear motion, uniform circular motion, harmonic motion (for all motion: definition and relationships between measures).

Dynamics

Vectors and operations on vectors. Forces, moments of forces about a point. Vector composition of forces. Definitions of mass and weight. Acceleration due to gravity. Density and specific gravity. Law of universal gravitation, 1st, 2nd and 3rd laws of motion. Work, kinetic energy, potential energy. Principle of conservation of energy.

Fluid mechanics

Pressure, and its units of measurement (not only in the SI system). Archimedes' principle. Pascal's principle. Stevino's law.

Thermodynamics

Thermometry and calorimetry. Specific heat, heat capacity. Mechanisms of heat propagation. Changes of state and latent heat. Ideal Gas Laws. First and second laws of thermodynamics.

Electrostatics and electrodynamics

Coulomb's law. Field and electric potential. Dielectric constant. Capacitors. Capacitors in series and in parallel. Direct current. Ohm's law. Electrical resistance and resistivity, electrical resistors in series and in parallel. Work, Power, Joule effect. Generators. Electromagnetic induction and alternating currents. Effects of electrical currents (thermal, chemical and magnetic).

Mathematics

Algebra and numerical sets

Natural numbers, integers, rational and real numbers. Sorting and comparison, scales and scientific notation. Operations and their properties. Proportions and percentages. Powers with whole and rational exponents and their properties. Roots and their properties. Logarithms (base 10 and base e) and their properties. Elements of combinatorics. Algebraic and polynomial expressions. Special products of binomials, n^{th} power of a binomial, factorisation of polynomials. Algebraic fractions. Algebraic equations and inequalities of the first and second order. Systems of equations.

Functions

Basic concepts of functions and their graphical representations (domain, codomain, sign, maxima and minima, increasing and decreasing, etc.). Elementary functions: whole and fractional algebraic functions, exponential, logarithmic and trigonometric functions. Composite functions and inverse functions. Trigonometric equations and inequalities.

Geometry

Polygons and their properties. Circle and circumference. Measurement of length, area and volume. Isometries, similarities and equivalences in the plane. Geometric loci. Measure angles in degrees and radians. Sine, cosine, tangent of an angle and their significant values. Trigonometric formulas. Solving triangles. Cartesian reference system in a plane. Distance between two points and the midpoint of a segment. Equation of a line. Concepts of parallel and perpendicular. Distance of a point from a straight line. Equation of the circle, the parabola, hyperbola, ellipse and their representation in the Cartesian plane. Pythagorean theorem.

Probability and Statistics

Frequency distributions and their graphic representations. Concepts of random experiments and of events. Probability and frequency.

Specimen Biology, Chemistry, Physics and Mathematics Questions

10 The diagram below shows a family tree of a condition known as nail patella syndrome (NPS).

Key

⭕ female without NPS   ⬜ male without NPS

⚫ female with NPS   ⬛ male with NPS
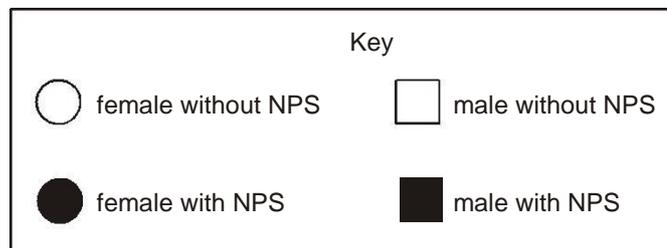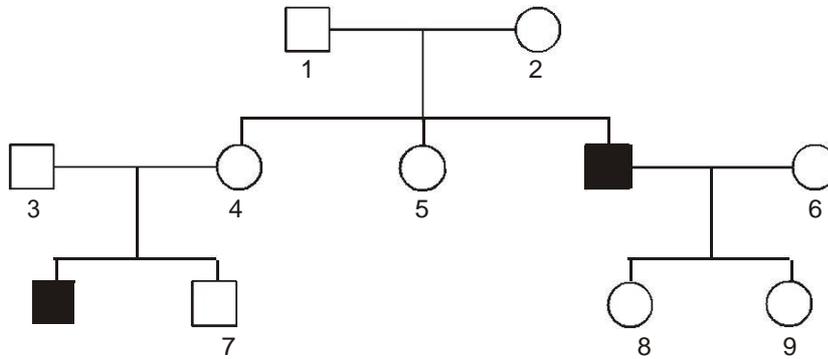
Which of the following pairs of individuals **must** be heterozygous for NPS?

A   1 and 5

B   2 and 6

C   3 and 7

D   4 and 8

E   5 and 9

11 An oxide of iron has the formula Fe_3O_4 and contains both Fe^{2+} and Fe^{3+} ions.

Which one of the following is the fraction of iron ions that are in the Fe^{2+} state?

A $^1/_4$

B $^1/_3$

C $^1/_2$

D $^2/_3$

E $^3/_4$

12 Below are four statements about thermal (heat) energy.

1 A substance can lose heat energy without its temperature falling.

2 Heat energy can pass through a vacuum.

3 Steam at 100^oC has more heat energy than the same mass of boiling water at 100^oC

4 When a container of water is cooled near the top, a convection current is set up in the water.

Which statements are true?

A 1, 2 and 3

B 2, 3 and 4

C 1, 2 and 4

D 1, 3 and 4

E all of the statements

13 The longest side of a right angled triangle is $6 + \sqrt{5}$ units.

One of the shorter sides is $3+2\sqrt{5}$ units.

What is the length of the third side?

A $2\sqrt{3}$

B $\sqrt{70+24\sqrt{5}}$

C 12

D $3-\sqrt{5}$

E $14+7.5\sqrt{5}$

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